AEROLOGICAL OBSERVATIONS

By L. T. SAMUELS

Free-air temperatures were abnormally high over the southern part of the country and abnormally low over the northern part. (See Table 1.) The pronounced degree to which this latitudinal temperature gradient obtained during the month is well shown by the difference between the mean temperatures for Ellendale and Groesbeck at the 3,500-meter level. This amounted to 16.5° C., whereas the normal difference between these two stations at this height in only 6.2° C. Note also that the difference 16.5° at 3,500 meters is 2.8° *greater* than the difference occurring between the surface at these two stations.

The positive monthly temperature departures for Groesbeck were exceptionally large, amounting to 5.5° C. at 3,500 meters. One of the effects of this abnormally warm air at the upper levels was a decided lack of precipitation throughout the month at this station, measurable amounts falling on only 3 days. At Ellendale, where the upper layers were colder than normal, there occurred an excess in the monthly precipitation, measurable amounts falling on 17 days and the total rainfall exceeded all previous amounts for May for at least 10 years.

The resultant winds at Ellendale, as might be expected in view of the abnormally low temperatures, contained a marked northerly component as compared with the normal southerly component. (See Table 2.) At Groesbeck, however, where temperatures were above normal, the resultant winds contained a greater southerly component than normally.

With but few minor exceptions the relative humidity departures for the month were of opposite sign to those for temperature. The largest departures occurred in the higher levels at Groesbeck, where also the greatest excess in temperature was found. In most cases the vapor pressures were of the same sign as those for temperature.

During the last five days of the month record temperatures prevailed at various levels at Broken Arrow, Groesbeck, and Royal Center. Normal values were exceeded by as much as 14° C. at the 1,500-meter level at Broken Arrow on the 28th. These high temperatures were associated with a pronounced low-pressure area, and as would be expected in view of the small lapse rates and low relative humidities, precipitation during this period was extremely scant.

The free-air winds as shown by pilot-balloon observations at Los Angeles on the 13th and 24th were of special significance in view of the fact that on the following days, viz, 14th and 25th, the surface temperatures at this station were exceptionally high, being 36.7° C. (98° F.) and 33.3° C. (92° F.), respectively. On both occasions this station was on the southwestern boundary of an extensive high-pressure area which covered the country west of the Rocky Mountains. The distinctive feature shown by the balloon observations was the existence of unusually deep southeasterly winds of low velocity. These reached 4,300 and 5,500 meters, respectively, on the dates mentioned.

TABLE 1.—*Free-air temperatures, relative humidities, and vapor pressures during May, 1927*

TEMPERATURE (° C.)

Altitude (m.) m. s. l.	Broken Arrow, Okla. (233m.) Mean	Broken Arrow, Okla. (233m.) Departure from 9-yr. mean	Due West, S. C. (217m.) Mean	Due West, S. C. (217m.) Departure from 7-yr. mean	Ellendale, N. Dak. (444m.) Mean	Ellendale, N. Dak. (444m.) Departure from 10-yr. mean	Groesbeck, Tex. (141m.) Mean	Groesbeck, Tex. (141m.) Departure from 9-yr. mean	Royal Center, Ind. (225m.) Mean	Royal Center, Ind. (225m.) Departure from 9-yr. mean	Washington, D. C.[1] (7m) (mean)
Surface	21.8	+2.0	22.3	+1.7	10.3	−2.9	24.0	+1.3	15.3	−1.1	21.1
250	21.7	+2.0	21.9	+1.6			23.1	+1.3	15.1	−1.0	18.9
500	20.2	+2.3	19.3	+1.3	9.9	−2.9	21.2	+1.2	12.9	−0.8	16.9
750	19.0	+2.1	17.8	+1.5	8.1	−3.0	19.9	+1.3	11.4	−0.6	15.0
1,000	17.6	+1.9	16.3	+1.5	6.6	−3.0	19.3	+1.8	10.2	−0.4	13.4
1,250	17.0	+2.4	14.5	+1.3	5.4	−2.8	19.4	+2.8	9.2	+0.1	11.8
1,500	16.7	+3.3	12.5	+0.8	4.3	−2.4	19.3	+3.6	8.1	+0.4	10.4
2,000	14.3	+3.6	9.6	+0.6	2.2	−1.6	17.9	+4.4	6.3	+1.1	7.4
2,500	11.3	+3.4	6.9	+0.6	−0.2	−1.0	15.5	+4.6	4.1	+1.4	4.8
3,000	8.0	+3.2	3.4	+0.1	−2.8	−0.8	12.6	+4.5	1.3	+1.4	
3,500	4.3	+2.6	−0.3	−0.5	−5.9	−1.1	10.6	+5.5	−1.7	+1.3	
4,000	0.5	+2.0	−3.2	−0.3	−9.0	−1.1			−4.8	+1.2	
4,500	−3.4	+1.1			−12.3	−1.0			−7.6	+1.1	
5,000									−11.0	+0.8	

RELATIVE HUMIDITY (%)

Surface	70	0	58	−4	75	+14	75	+3	72	+8	52
250	70	0	58	−4			77	+4	72	+8	55
500	67	−1	60	−3	75	+14	79	+5	74	+10	57
750	65	−2	59	−5	76	+16	78	+5	76	+12	57
1,000	65	−1	59	−5	76	+16	73	+3	76	+12	57
1,250	59	−5	61	−4	76	+16	61	−4	72	+9	58
1,500	52	−9	63	−2	76	+16	49	−11	70	+7	59
2,000	50	−8	55	−7	73	+13	30	−22	61	+2	61
2,500	45	−10	50	−9	72	+13	23	−26	54	0	58
3,000	41	−12	53	−3	69	+12	21	−27	54	+3	
3,500	37	−15	63	+8	66	+12	19	−27	48	−2	
4,000	37	−16	64	+12	63	+11			41	−5	
4,500	46	−7			66	+13			36	−6	
5,000									38	−4	

VAPOR PRESSURE (*mb*)

Surface	18.75	+2.19	15.81	+0.78	9.39	+0.06	22.64	+2.83	12.82	+0.81	13.82
250	18.57	+2.16	15.66	+0.87			21.98	+2.94	12.91	+1.07	12.81
500	16.29	+1.85	13.96	+0.85	9.14	+0.06	20.17	+2.88	11.47	+1.26	11.67
750	14.67	+1.67	12.67	+0.74	8.26	+0.23	18.36	+2.68	10.65	+1.50	10.35
1,000	13.38	+1.47	11.58	+0.69	7.51	+0.22	15.99	+2.11	9.90	+1.57	9.43
1,250	11.55	+0.88	10.78	+0.81	6.95	+0.25	13.02	+1.03	8.77	+1.26	8.64
1,500	9.91	+0.55	9.72	+0.67	6.46	+0.36	10.28	+0.02	7.80	+1.06	8.00
2,000	7.96	+0.51	6.77	−0.40	5.34	+0.39	5.90	−1.64	6.04	+0.80	6.66
2,500	5.54	−0.21	4.84	−0.80	4.35	+0.43	3.60	−2.29	4.43	+0.56	5.08
3,000	4.10	−0.43	3.77	−0.66	3.41	+0.34	2.42	−2.40	2.56	+0.74	
3,500	2.97	−0.68	3.19	−0.37	2.63	+0.26	2.05	−1.76	2.37	+0.23	
4,000	2.08	−0.87	2.22	−0.49	2.03	+0.23			1.57	+0.13	
4,500	1.68	−0.70			1.63	+0.24			1.09	+0.04	
5,000									0.90	+0.03	

[1] Naval air station, D. C.

TABLE 2.—*Free-air resultant winds (m. p. s.) during May, 1927*

Altitude (m) m. s. l.	Broken Arrow, Okla. (233 meters) Mean Dir.	Mean Vel.	9-year mean Dir.	9-year mean Vel.	Due West, S. C. (217 meters) Mean Dir.	Mean Vel.	7-year mean Dir.	7-year mean Vel.	Ellendale, N. Dak. (444 meters) Mean Dir.	Mean Vel.	10-year mean Dir.	10-year mean Vel.	Groesbeck, Tex. (141 meters) Mean Dir.	Mean Vel.	9-year mean Dir.	9-year mean Vel.	Royal Center, Ind. (225 meters) Mean Dir.	Mean Vel.	9-year mean Dir.	9-year mean Vel.	Washington, D. C. (34 meters) Mean Dir.	Mean Vel.	7-year mean Dir.	7-year mean Vel.
Surface	S. 10° W.	5.1	S. 8° E.	2.1	S. 78° W.	3.8	S. 84° W.	1.0	N. 8° E.	2.9	N. 7° E.	0.7	S. 2° W.	5.6	S. 7° E.	2.4	S. 58° W.	1.7	S. 75° W.	0.4	N. 89° W.	0.9	N. 46° W.	0.8
250	S. 10° W.	5.3	S. 8° E.	2.2	S. 76° W.	4.2	S. 79° W.	1.1					S. 1° W.	6.1	S. 6° E.	3.0	S. 53° W.	1.8	S. 63° W.	0.4	N. 84° W.	2.0	N. 71° W.	1.8
500	S. 11° W.	6.6	S. 2° W.	3.0	S. 72° W.	6.2	S. 81° W.	1.9	N. 8° E.	2.9	N. 10° E.	0.5	S. 2° W.	7.8	S.	4.3	S. 46° W.	3.9	S. 58° W.	1.5	S. 89° W.	4.0	N. 74° W.	2.8
750	S. 14° W.	7.2	S. 7° W.	3.4	S. 78° W.	7.7	S. 82° W.	2.7	N. 19° E.	2.4	S. 61° E.	0.2	S. 3° W.	9.4	S. 7° W.	4.9	S. 49° W.	4.8	S. 68° W.	2.2	S. 85° W.	5.0	N. 72° W.	3.7
1,000	S. 25° W.	7.9	S. 22° W.	3.7	S. 79° W.	9.0	S. 85° W.	3.3	N. 26° E.	1.7	S.	0.4	S. 12° W.	10.0	S. 18° W.	5.4	S. 61° W.	5.6	S. 80° W.	2.9	S. 87° W.	5.7	N. 73° W.	4.3
1,250	S. 33° W.	8.9	S. 36° W.	4.0	S. 83° W.	10.6	S. 81° W.	4.5	N. 2° E.	0.9	S. 29° W.	0.8	S. 19° W.	9.9	S. 26° W.	5.4	S. 65° W.	7.1	S. 88° W.	3.5				
1,500	S. 47° W.	8.8	S. 47° W.	4.3	S. 81° W.	11.1	S. 78° W.	5.5	N. 37° W.	1.4	S. 41° W.	1.2	S. 26° W.	9.4	S. 33° W.	5.1	S. 66° W.	8.3	S. 85° W.	3.8	N. 82° W.	6.9	N. 68° W.	5.6
2,000	S. 59° W.	9.1	S. 63° W.	4.7	S. 78° W.	11.5	S. 80° W.	6.8	N. 63° W.	3.1	S. 64° W.	2.3	S. 28° W.	8.4	S. 45° W.	5.0	S. 75° W.	10.4	S. 87° W.	6.3	N. 83° W.	9.2	N. 71° W.	6.8
2,500	S. 68° W.	9.8	S. 79° W.	5.6	S. 77° W.	12.8	S. 81° W.	9.0	N. 87° W.	5.1	S. 67° W.	3.9	S. 36° W.	6.2	S. 59° W.	5.1	S. 81° W.	13.0	N. 88° W.	6.4	N. 85° W.	11.4	N. 71° W.	7.1
3,000	S. 80° W.	9.5	W.	6.2	S. 78° W.	12.6	S. 85° W.	8.9	N. 77° W.	8.0	S. 73° W.	5.5	S. 43° W.	5.5	S. 74° W.	6.1	N. 88° W.	15.1	N. 79° W.	8.3	S. 86° W.	13.0	N. 75° W.	7.3
3,500	S. 78° W.	12.1	N. 86° W.	7.7	N. 82° W.	12.1	N. 86° W.	10.0	N. 84° W.	11.1	S. 81° W.	6.4	S. 72° W.	8.4	S. 86° W.	7.4	N. 84° W.	14.0	N. 76° W.	8.4	N. 78° W.	13.5	N. 66° W.	7.3
4,000	S. 89° W.	12.5	N. 85° W.	8.5	N. 67° W.	13.6	N. 72° W.	11.8	S. 83° W.	11.1	N. 88° W.	8.1	W.	20.0	N. 76° W.	10.1	N. 85° W.	13.4	N. 85° W.	8.8	N. 68° W.	14.9	N. 62° W.	7.6
4,500	N. 66° W.	12.5	N. 77° W.	9.1					N. 77° W.	17.2	N. 70° W.	7.5					N. 85° W.	17.4	N. 85° W.	12.5	N. 62° W.	15.2	N. 50° W.	7.3
5,000									W.	20.0	N. 58° W.	3.2					N. 78° W.	21.1	N. 79° W.	14.4	N. 70° W.	18.2	N. 52° W.	8.5